

Calibration of the Pitot Steam Meter

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Carr, A.L.
Calibration of the Pitot
SteamMeter

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THE CALIBRATION
OF THE
PITOT STEAM METER
A THESIS

PRESENTED BY

A. L. CARR
&
H. L. STRUBE

TO THE

PRESIDENT AND FACULTY

OF

ARMOUR INSTITUTE OF TECHNOLOGY

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

HAVING COMPLETED THE PRESCRIBED COURSE OF STUDY IN

MECHANICAL ENGINEERING

JUNE 4, 1906.

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Calibration of the Pitot Steam Meter

The object in view in this thesis work was to obtain experimental data for the calibration of a steam meter or instrument for measuring the flow of steam in a pipe. If possible a scale was to be provided which would give the velocity of steam in feet per minute or the quantity in pounds per hour, so that the instrument might be set up on any size steam pipe and those quantities be observed at a glance. The constant of the pitot tube was to be determined by calculating the ratio of the actual velocity in the pipe to the theoretical velocity.

In order to determine the practicability of the instrument, tests were made on pipes varying in size from one inch to three inches in diameter and with velocities varying from 500 to 10000 feet per minute; also with pressures varying from 60 to 90 pounds gauge.

The principle upon which the instrument is based is that of the well known Pitot tube. Referring to the accompanying sketch, the Pitot Steam Velocity meter may be described as follows:- The meter consists of two parallel tubes each a little over two feet in length and connected at the extremities by hollow castings. One of the tubes is an ordinary gauge glass which has been surrounded

by a metallic sleeve having graduated upon it a scale divided into inches and tenths of inches up to 25 inches. The other is an ordinary one half inch pipe and is called the pressure tube. The tubes are meant to be mounted vertically in order to give correct readings of the scale. It is seen that a small tube called the Pitot tube extends from the lower opening. It is about $3/32$ -inch internal diameter and is meant to project into the pipe so that its end is in the center of the steam pipe. The opening of this tube is made to face at right angles to the flow of steam in the pipe. The other end of the pitot tube is screwed into a diaphragm made into the hollow casting which prevents steam from entering the lower opening of the gauge glass except through the pitot tube itself. This diaphragm is set back far enough in the casting to allow the steam entering the $1/2$ inch pipe and surrounding the pitot tube, to flow up the pressure tube and over into the top of the gauge glass. In flowing up this tube and entering the gauge glass the steam is condensed and gravitates down the glass to form a head of water.

Since the pitot tube allows both pressure and velocity heads to be exerted at the lower opening of the gauge glass while only a pressure head is exerted from above; it is evident that the two pressures will exactly neutralize each other leaving only the velocity head.

This velocity head is then determined from the height of water or condensed steam in the glass, by the well known hydraulic formula $V = \sqrt{2gh}$ when

h = head in feet of steam

g = gravity

v = velocity in feet per second

This formula is not exactly correct for a gas or a vapor, as steam, but is sufficiently correct for all practical purposes and may be used here. The head in inches of water may easily be converted to feet of steam by multiplying the height by the ratio of the density of water to steam at the given temperature and pressure in the pipe.

The flow of steam through the meter is controlled by means of the angle valves.

The instrument is attached to a pipe by means of a union and 1/2 inch nipple, the latter screwing into a hole tapped into the pipe directly or into a fitting. The end of this nipple is meant to come flush with the internal surface of the steam pipe so as to preclude the possibility of eddy currents, etc, from creating a false pressure. The head of water in the gauge glass is balanced by the velocity head because of the impulse of the moving steam, the latter striking the opening of the pitot tube.

The arrangement of the apparatus is shown in Fig.

2. Steam was allowed to flow through the pipe to be tested and was condensed in a surface condenser; from which it was discharged into weighing tanks. From the known area of the pipe and the known quantity of steam the actual velocity of the steam flowing through the pipe may be obtained. The quantity of steam is obtained from the weight of water by multiplying the latter by the volume of one pound of steam at the known pressure. Thus the actual velocity in feet per minute is equal to ---- weight of water per minute \times specific volume of steam at the pressure divided by the area of the pipe in square ft. The theoretical velocity is obtained approximately from the formula $V = \sqrt{2gh}$

The ratio of the actual to the theoretical velocity will give the constant of the tube. It should be unity provided the pressure part of the instrument is designed properly.

Referring to Fig. 2 it is seen that the upper valve controls the pressure of the steam flowing through the pipe to be tested while the lower one controls the velocity. In starting a run both these valves are opened to allow steam to flow through to the condenser. Both the angle valves on the meter itself are previously closed. Then the upper angle valve is opened slightly at first to

allow the gauge glass to gradually become heated. After this valve has been opened wide, the steam is allowed to condense in the ~~open~~^{upper} casting and fill the gauge glass.

The lower angle valve is then opened and this condensed steam allowed to adjust itself to the proper head corresponding to the velocity of the steam flowing through the pipe. Runs of five minutes were taken and readings of the instrument made every minute, care being taken to keep the pressure constant. This is essential, as any change in pressure will cause a change in head which will be proportional to the square of the velocity. In most of the later experiments five different velocities were obtained for each pressure in order that five points be obtained for curves to be plotted with meter readings and velocities in feet per minute as coordinates.

The first series of experiments were made on a three-inch pipe. The connecting nipple was in this case screwed into a hole tapped in the pipe. The meter was set at an angle of about $12\frac{1}{2}$ degrees with the horizontal and a run made with constant pressure, but with velocity heads varying the length of the tube. This angle of $12\frac{1}{2}$ degrees gave a maximum vertical head ^{of} $61\frac{1}{2}$ inches of water. The object of tipping the instrument at an angle was to obtain readings which would be more sensitive



to any change of velocity for low velocities. The range in velocity is not as great as when vertical, but it is enough for all practical purposes. A new instrument is being made with a slant of about 12 degrees which will have a scale reading the actual vertical head of water. Referring to the data obtained (see blue print Apr. 18) it will be seen that the maximum velocity obtained with the instrument at 12 $\frac{1}{2}$ degrees to the horizontal, was over 5000 feet per minute which is greater than any velocity obtained in practice.

Next a series of runs were made upon a one inch pipe in which the connecting nipple was screwed into the $\frac{1}{2}$ inch opening of a $1 \times 1 \times \frac{1}{2}$ inch tee. We were unsuccessful in securing reliable results in this case because the pressure head was evidently affected by the opening to the pressure tube. A considerable cavity is left at the opening to the pressure tube inside the tee which causes the steam to swirl and eddy at this point thereby effecting the readings of the meter by unbalancing the pressure heads. A special fitting was therefore made which did away with this defect. A number of runs were taken with this fitting and the constant of the pitot tube averaged about 0.794. In figuring this constant all the constants were averaged (for different velocities). It is thought that

those obtained for low velocities were incorrect because they differ from the others by so great an amount. If these are left out the constant will become 0.82.

When attached to a 2-inch pipe the constant of the meter was calculated to average about 0.88. The connecting nipple was screwed into a $1/2$ inch hole tapped into the pipe the same as with the 3 inch pipe. The results obtained are believed to be reliable because all conditions were as nearly constant as it was possible to make them. However as in the case of a one inch pipe, the lower velocity readings appear to be unreliable.

With a $2\ 1/2$ inch pipe the nipple attachment was screwed into the $1/2$ inch opening of a $2\ 1/2 \times 1/2$ inch cross fitting. The same trouble was encountered with this fitting as with the one inch tee, namely, that eddy currents affected the pressure head to such an extent as to spoil the readings of the meter. The constant of the tube figures out to be only 0.54 which is ~~only~~ evidently incorrect. These results will not be found with the other data as they are believed to be incorrect.

The $2\ 1/2$ inch pipe carried steam to a cross-compound engine, so the behavior of the instrument, when attached to a pipe through which steam was flowing to a running engine, was observed. The column of condensed steam did not fluctuate any more when the engine was run-



ning than when the steam was being blown through the pipe, thus proving that this instrument may be successfully used to measure the flow of steam in a pipe leading to a running engine or turbine.

Runs were next taken on a 3-inch pipe during which the instrument was kept in a vertical position. It was impossible to get more than a 5-inch head of water because of the large size of pipe requiring a great quantity of steam. However it will be seen that the constant of the tube is nearly unity for the results obtained. The average constant for the 3-inch pipe is 0.95. This quantity was lowered by two runs which were probably incorrect viz., those giving constants of 0.862 and 0.835 ; with these two results left out the average constant would be 0.98 which is as near unity as the accuracy of experimental work would allow.

It will be noticed that as the size of pipe increased, the size of the constant also increased. Altho' the opening of the pitot tube was at the center of the stream pipe in each case, it is probable that with the smaller size pipes, the swirling of the steam in the pipe effected the readings. Then again it may be due to the pitot tubes themselves since different tubes were used for each size of pipe. Had time permitted we would have

determined the effect of shifting the pitot tube across the diameter of the pipe and found the best position in which to leave the tube while making a run. Therefore it was thought best to place the opening of the tube in the center of the pipe which is not necessarily the mean velocity center or radius. The quality of steam and the pressure also affects the readings of the instrument. By the time the steam reached the meter in our apparatus it contained considerable moisture, although every means outside of a separator were used to lower the percentage. No determinations of quality were made.

The accompanying curves show the relation between the meter readings and the velocity of steam in feet per minute; also the weights of steam in pounds per hour and meter readings. The best curves were obtained with the 2 inch pipe and show the relation between the actual and the theoretical values of velocity. As previously stated the range in heads is not great enough with the 3 inch pipe to give valuable curves. The results would probably be more nearly correct had the tube been tilted as it was in the first case.

An example of the method of calculating results is shown below;

(From data obtained on June 1)

pressure of steam = 88 pounds absolute

specific volume of steam at 88# = 4.96 cu. ft.

Temp. of steam at 88# = 325 degrees F.

weight of one cu. ft. of water at 325 degrees = 56.65

weight of one cu. ft. of steam at 88# = 0.201

average meter reading for 5 minutes run = 5.5

weight of steam flowing thru pipe in 5 minutes = 249#

area of three inch pipe = 0.0491 sq. ft.

Therefore actual velocity of steam $\frac{249 \times 4.96}{5 \times 0.0491} = 5030$ ft min.

Theoretical velocity of steam $V = \sqrt{2gh}$ approximately
 $= 8.025 \times 60 \sqrt{\frac{5.5 \times 56.65}{12 \times .201}} = 5470$ ft. per minute
5030

Therefore the constant of the pitot tube is $\frac{5030}{5470} = .921$

The results of the tests on this pitot steam meter show that it may be used successfully in practice for the measurement of the flow of steam in a pipe. It was shown that the instrument could be easily and quickly attached to any steam pipe and for high velocities the results obtained were fairly constant. The new instrument which was designed for lower velocities such as those of steam flowing to a running engine, e.g. 2000 feet per min., will undoubtedly give better results for these lower velocities. The head of water for the instrument is very sensitive to any change ⁱⁿ pressure or velocity in the steam

pipe and for this reason would be very valuable in practice, especially for use in tests. An idea of the actual amount of steam consumed by an engine may be obtained which might result in greater economy being practiced by the engineer in charge.

While the tests were necessarily cut short, still enough data was obtained to give an idea of the practicability of the instrument.

R. L. Carr
H. L. Strube



WATER PUMP - 1/2" - 1/2" - 1/2"

WATER PUMP - 1/2" - 1/2" - 1/2"

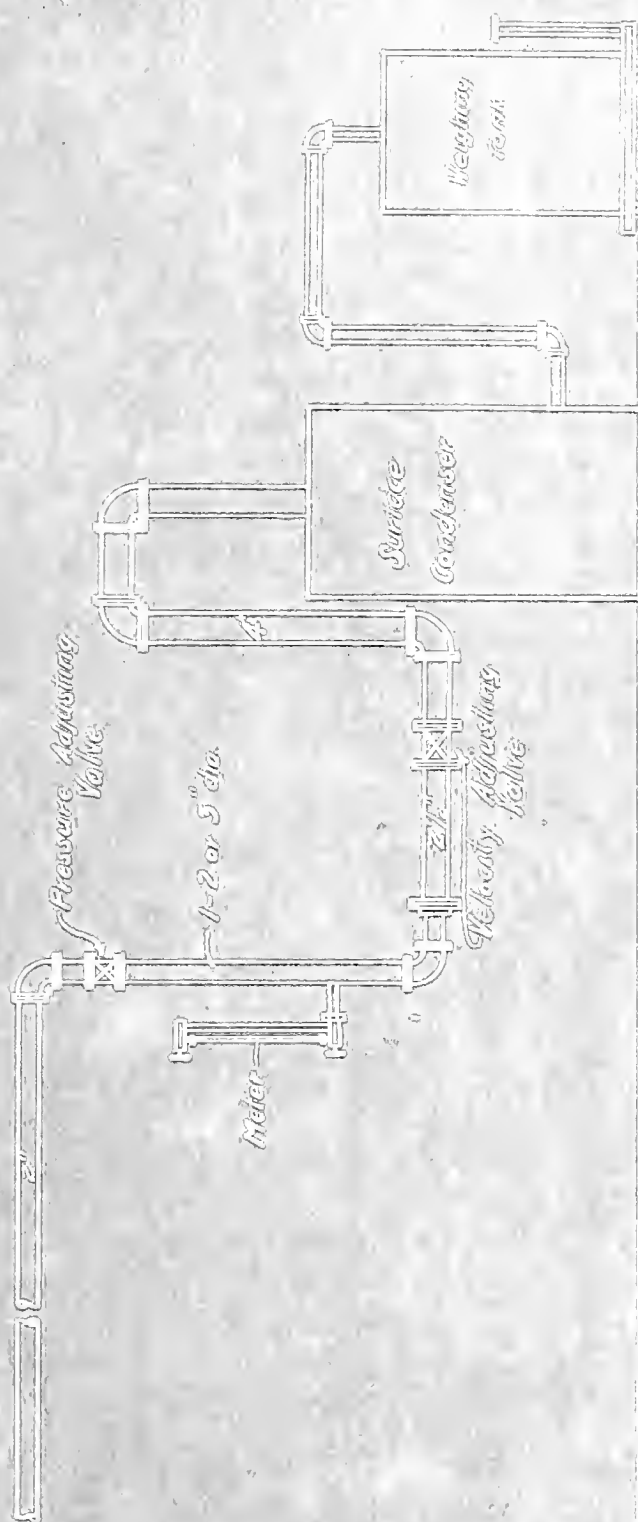


Fig. 2.

New No. 1141. (continued)

1773

Date	Description	To the credit of	By the debit of	Balance	Total	Cash
1773	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1774	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1775	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1776	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1777	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1778	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1779	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1780	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1781	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1782	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1783	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1784	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1785	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1786	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1787	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1788	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1789	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1790	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1791	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1792	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1793	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1794	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1795	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash
1796	1102-2-2	To the credit of	By the debit of	Balance	Total	Cash

Misses F.C. & A. 1870-1871		1 st Period				
Week	Mon. F.C.	Tues. A.	Wed. F.C.	Thurs. A.	Friday F.C.	Saturday A.
1	Sept 1	Sept 2	Sept 3	Sept 4	Sept 5	Sept 6
2	Sept 7	Sept 8	Sept 9	Sept 10	Sept 11	Sept 12
3	Sept 13	Sept 14	Sept 15	Sept 16	Sept 17	Sept 18
4	Sept 19	Sept 20	Sept 21	Sept 22	Sept 23	Sept 24
5	Sept 25	Sept 26	Sept 27	Sept 28	Sept 29	Sept 30
6	Sept 31	Sept 32	Sept 33	Sept 34	Sept 35	Sept 36
7	Sept 37	Sept 38	Sept 39	Sept 40	Sept 41	Sept 42
8	Sept 43	Sept 44	Sept 45	Sept 46	Sept 47	Sept 48
9	Sept 49	Sept 50	Sept 51	Sept 52	Sept 53	Sept 54
10	Sept 55	Sept 56	Sept 57	Sept 58	Sept 59	Sept 60
11	Sept 61	Sept 62	Sept 63	Sept 64	Sept 65	Sept 66
12	Sept 67	Sept 68	Sept 69	Sept 70	Sept 71	Sept 72
13	Sept 73	Sept 74	Sept 75	Sept 76	Sept 77	Sept 78
14	Sept 79	Sept 80	Sept 81	Sept 82	Sept 83	Sept 84
15	Sept 85	Sept 86	Sept 87	Sept 88	Sept 89	Sept 90
16	Sept 91	Sept 92	Sept 93	Sept 94	Sept 95	Sept 96
17	Sept 97	Sept 98	Sept 99	Sept 100	Sept 101	Sept 102
18	Sept 103	Sept 104	Sept 105	Sept 106	Sept 107	Sept 108
19	Sept 109	Sept 110	Sept 111	Sept 112	Sept 113	Sept 114
20	Sept 115	Sept 116	Sept 117	Sept 118	Sept 119	Sept 120
21	Sept 121	Sept 122	Sept 123	Sept 124	Sept 125	Sept 126
22	Sept 127	Sept 128	Sept 129	Sept 130	Sept 131	Sept 132
23	Sept 133	Sept 134	Sept 135	Sept 136	Sept 137	Sept 138
24	Sept 139	Sept 140	Sept 141	Sept 142	Sept 143	Sept 144
25	Sept 145	Sept 146	Sept 147	Sept 148	Sept 149	Sept 150
26	Sept 151	Sept 152	Sept 153	Sept 154	Sept 155	Sept 156
27	Sept 157	Sept 158	Sept 159	Sept 160	Sept 161	Sept 162
28	Sept 163	Sept 164	Sept 165	Sept 166	Sept 167	Sept 168
29	Sept 169	Sept 170	Sept 171	Sept 172	Sept 173	Sept 174
30	Sept 175	Sept 176	Sept 177	Sept 178	Sept 179	Sept 180
31	Sept 181	Sept 182	Sept 183	Sept 184	Sept 185	Sept 186
32	Sept 187	Sept 188	Sept 189	Sept 190	Sept 191	Sept 192
33	Sept 193	Sept 194	Sept 195	Sept 196	Sept 197	Sept 198
34	Sept 199	Sept 200	Sept 201	Sept 202	Sept 203	Sept 204
35	Sept 205	Sept 206	Sept 207	Sept 208	Sept 209	Sept 210
36	Sept 211	Sept 212	Sept 213	Sept 214	Sept 215	Sept 216
37	Sept 217	Sept 218	Sept 219	Sept 220	Sept 221	Sept 222
38	Sept 223	Sept 224	Sept 225	Sept 226	Sept 227	Sept 228
39	Sept 229	Sept 230	Sept 231	Sept 232	Sept 233	Sept 234
40	Sept 235	Sept 236	Sept 237	Sept 238	Sept 239	Sept 240
41	Sept 241	Sept 242	Sept 243	Sept 244	Sept 245	Sept 246
42	Sept 247	Sept 248	Sept 249	Sept 250	Sept 251	Sept 252
43	Sept 253	Sept 254	Sept 255	Sept 256	Sept 257	Sept 258
44	Sept 259	Sept 260	Sept 261	Sept 262	Sept 263	Sept 264
45	Sept 265	Sept 266	Sept 267	Sept 268	Sept 269	Sept 270
46	Sept 271	Sept 272	Sept 273	Sept 274	Sept 275	Sept 276
47	Sept 277	Sept 278	Sept 279	Sept 280	Sept 281	Sept 282
48	Sept 283	Sept 284	Sept 285	Sept 286	Sept 287	Sept 288
49	Sept 289	Sept 290	Sept 291	Sept 292	Sept 293	Sept 294
50	Sept 295	Sept 296	Sept 297	Sept 298	Sept 299	Sept 300
51	Sept 301	Sept 302	Sept 303	Sept 304	Sept 305	Sept 306
52	Sept 307	Sept 308	Sept 309	Sept 310	Sept 311	Sept 312
53	Sept 313	Sept 314	Sept 315	Sept 316	Sept 317	Sept 318
54	Sept 319	Sept 320	Sept 321	Sept 322	Sept 323	Sept 324
55	Sept 325	Sept 326	Sept 327	Sept 328	Sept 329	Sept 330
56	Sept 331	Sept 332	Sept 333	Sept 334	Sept 335	Sept 336
57	Sept 337	Sept 338	Sept 339	Sept 340	Sept 341	Sept 342
58	Sept 343	Sept 344	Sept 345	Sept 346	Sept 347	Sept 348
59	Sept 349	Sept 350	Sept 351	Sept 352	Sept 353	Sept 354
60	Sept 355	Sept 356	Sept 357	Sept 358	Sept 359	Sept 360
61	Sept 361	Sept 362	Sept 363	Sept 364	Sept 365	Sept 366
62	Sept 367	Sept 368	Sept 369	Sept 370	Sept 371	Sept 372
63	Sept 373	Sept 374	Sept 375	Sept 376	Sept 377	Sept 378
64	Sept 379	Sept 380	Sept 381	Sept 382	Sept 383	Sept 384
65	Sept 385	Sept 386	Sept 387	Sept 388	Sept 389	Sept 390
66	Sept 391	Sept 392	Sept 393	Sept 394	Sept 395	Sept 396
67	Sept 397	Sept 398	Sept 399	Sept 400	Sept 401	Sept 402
68	Sept 403	Sept 404	Sept 405	Sept 406	Sept 407	Sept 408
69	Sept 409	Sept 410	Sept 411	Sept 412	Sept 413	Sept 414
70	Sept 415	Sept 416	Sept 417	Sept 418	Sept 419	Sept 420
71	Sept 421	Sept 422	Sept 423	Sept 424	Sept 425	Sept 426
72	Sept 427	Sept 428	Sept 429	Sept 430	Sept 431	Sept 432
73	Sept 433	Sept 434	Sept 435	Sept 436	Sept 437	Sept 438
74	Sept 439	Sept 440	Sept 441	Sept 442	Sept 443	Sept 444
75	Sept 445	Sept 446	Sept 447	Sept 448	Sept 449	Sept 450
76	Sept 451	Sept 452	Sept 453	Sept 454	Sept 455	Sept 456
77	Sept 457	Sept 458	Sept 459	Sept 460	Sept 461	Sept 462
78	Sept 463	Sept 464	Sept 465	Sept 466	Sept 467	Sept 468
79	Sept 469	Sept 470	Sept 471	Sept 472	Sept 473	Sept 474
80	Sept 475	Sept 476	Sept 477	Sept 478	Sept 479	Sept 480
81	Sept 481	Sept 482	Sept 483	Sept 484	Sept 485	Sept 486
82	Sept 487	Sept 488	Sept 489	Sept 490	Sept 491	Sept 492
83	Sept 493	Sept 494	Sept 495	Sept 496	Sept 497	Sept 498
84	Sept 499	Sept 500	Sept 501	Sept 502	Sept 503	Sept 504
85	Sept 505	Sept 506	Sept 507	Sept 508	Sept 509	Sept 510
86	Sept 511	Sept 512	Sept 513	Sept 514	Sept 515	Sept 516
87	Sept 517	Sept 518	Sept 519	Sept 520	Sept 521	Sept 522
88	Sept 523	Sept 524	Sept 525	Sept 526	Sept 527	Sept 528
89	Sept 529	Sept 530	Sept 531	Sept 532	Sept 533	Sept 534
90	Sept 535	Sept 536	Sept 537	Sept 538	Sept 539	Sept 540
91	Sept 541	Sept 542	Sept 543	Sept 544	Sept 545	Sept 546
92	Sept 547	Sept 548	Sept 549	Sept 550	Sept 551	Sept 552
93	Sept 553	Sept 554	Sept 555	Sept 556	Sept 557	Sept 558
94	Sept 559	Sept 560	Sept 561	Sept 562	Sept 563	Sept 564
95	Sept 565	Sept 566	Sept 567	Sept 568	Sept 569	Sept 570
96	Sept 571	Sept 572	Sept 573	Sept 574	Sept 575	Sept 576
97	Sept 577	Sept 578	Sept 579	Sept 580	Sept 581	Sept 582
98	Sept 583	Sept 584	Sept 585	Sept 586	Sept 587	Sept 588
99	Sept 589	Sept 590	Sept 591	Sept 592	Sept 593	Sept 594
100	Sept 595	Sept 596	Sept 597	Sept 598	Sept 599	Sept 600

Mr. J. W. Brown

Mr. J. W. Brown

1871

1872

1873

1874

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Mr. J. W. Brown

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Mr. J. W. Brown

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Mr. J. W. Brown

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Mr. J. W. Brown

1871

1872

1873

1874

1875

May 22, 1906 (cont'd)

1st Pipe

Time	Mrs. Persim	Water Reaching	Wts. of Water	Actual Vel	Theo Vel	Constant
11:41	94.7	94.4	5.55			
47	do	10.0				
48	do	10.1		54.40	70.50	0.772
44	do	9.7				
45	do	9.9				
46	do	9.9	52.5			
11:50	94.7	14.2	5.85			
51	do	14.3				
52	do	14.5		66.80	86.50	0.7469
53	do	14.7				
54	do	15.1				
55	do	15.4	62.55			
56	do					
57	94.7	17.8	5.74			
58	do	17.8				
59	do	17.9		75.55	94.50	0.800
60	do	17.7				
61	do	17.5				
62	do	17.4	61.9			

Nov 22. (cont'd)

1" Pipe

Throat	Abs. Pressure	Height of Water	Wts. of Water	Actual Vel	Theo. Vel	Constant
4.10	84.7	16.9	557.5			
11	86	16.9				
12	86	17.2		88.50	98.70	0.896
13	86	17.4				
14	86	17.6				
15	86	17.4	549.5			
4.20	84.7	23.1	549.5			
7.1	86	24.0				
7.2	86	25.2		97.00	105.90	0.8937
7.3	86	25.2				
7.4	86	24.2				
7.5	86	25.6	651			

May 25 (cont'd)

Time	Atm. Pressure	Mercurial Reading	Wts. of Water	Actual Vel	Theo. Vel	Constant
1 st 510	103.2	5.0	1074.5			
51	etc.	5.1				
52	etc.	etc.				
53	etc.	etc.		4190	4855	0.862
54	etc.	etc.				
55	etc.	etc.	11181.5			
1 st 513	103.2	1.1	545			
514	etc.	1.05				
2 nd 610	etc.	1.0		7215.5	7187	0.9155
2 nd 611	etc.	0.95				
2 nd 612	etc.	1.05				
2 nd 613	etc.	1.05	600			
2 nd 141	99.7	1.15	600			
15	etc.	1.0				
16	etc.	1.05		7228.5	7270	1.006
17	etc.	1.0				
18	etc.	1.1				
19	etc.	1.0	655.5			

May 25 (cont'd)

Time	Abs. Pressure	Water Footing	Wt. of Water	Actual Vol	Theor. Vol	Constant
3:07	93.2	15.5	541.5			
08	cb	15.5				
09	cb	15.45		7680	8900	0.863
10	cb	15.4				
11	cb	15.35				
12	cb	15.5	719.5			
3:14	93.2	9.65	719.5			
15	cb	9.6				
16	cb	9.7		612.10	710.50	0.8624
17	cb	9.7				
18	cb	9.7				
19	cb	9.65	616.35			
3:24	93.2	5.05	616.35			
22	cb	5.1				
23	cb	cb		464.5	577.50	0.8105
24	cb	cb				
25	cb	cb				
26	cb	cb	9.71			

Page 134 (cont'd)	
Time	Place / Remarks
8:00 AM	1931
8:15	1931
8:30	1931
8:45	1931
9:00	1931

May 25 (cont'd)

Time	Abs. Pressure	Water Reading	Wts. of Water	Actual Vol.	Theo. Vol.	Constant
3:59	88.2	9.95	539.5			
4:00	86	9.9				
4:01	86	9.4		644.0	772.410	0.887
4:02	86	9.4				
4:03	86	9.55				
4:04	89	9.9	631.5			
4:11	89.5	10.65	612.1			
4:12	86	10.0				
4:13	86	10.5		612.41	744.75	0.836
4:14	86	10.55				
4:15	86	10.55				
4:16	86	10.6	615.0.5			
4:17	89.5	11.0	616.0			
4:18	86	10.4				
4:19	86	10.4		616.0.5		
4:20	86	10.4				
4:21	86	10.4				
4:22	86	10.4				
4:23	86	10.4				
4:24	86	10.4				
4:25	86	10.4				
4:26	86	10.4				
4:27	86	10.4				
4:28	86	10.4				
4:29	86	10.4				
4:30	86	10.4				
4:31	86	10.4				
4:32	86	10.4				
4:33	86	10.4				
4:34	86	10.4				
4:35	86	10.4				
4:36	86	10.4				
4:37	86	10.4				
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May 25. (cont'd)

2nd Pipe

Time	Abs. Pressure	Water Reading	Wt. of Water	Actual Well	Water Well	Constant
4:35	83.2	9.3	11043.5			
36	do	9.45				
37	do	9.4		6.590	7240	0.548
38	do	9.4				
39	do	9.35				
40	do	9.4	1116.1			
4:43	83.2	5.0	724.5			
44	do	5.1				
45	do	5.1		4.89	724.0	0.548
46	do	5.2				
47	do	5.1				
48	do	5.1	824.5			
4:50	83.2	1.245	824.5			
51	do	1.25				
52	do	1.25		5.04	724.5	
53	do	1.25				
54	do	1.6				
55	do	1.65	916.5			

June 1, cont'd

5th Run

Turn	Obs. Pressure	Dist. Direction	Wts. of Water	Depth	When Met	Count
10.35	101.7	4.9	5.58			
36	do	4.8				
37	do	4.5		3730	44.10	0.836
38	do	4.4				
39	do	4.0				
40	do	3.6	7.70			
10.47	101.7	1.9	7.70			
41	do	1.9				
42	do	2.0		510.5	49.00	1.097
43	do	1.95				
44	do	2.05				
45	do	2.0	4.50			
10.50	99.7	5.8	5.54			
51	do	4.0				
52	do	4.5		415.0	49.00	0.977
53	do	4.5				
54	do	4.8				
55	do	4.0	7.50			

June 1. (cont'd)

3" Pipe

Time	Abs. Pressure	Meter Reading	Wts. of Water	Actual Vel	Theo. Vel	Constant
10:57	97	3.4	756			
58	do	3.5				
59	do	3.9		3600	4225	0.862
11:00	do	3.9				
01	do	3.8				
02	do	3.9	951			
11:10	97	1.4	545			
11	do	do				
12	do	do		2785	2625	1.06
13	do	do				
14	do	do				
15	do	do	694			
11:23	97	2.3	694			
24	do	2.35				
25	do	2.45		3190	3320	0.963
26	do	2.0				
27	do	2.1				
28	do	2.2	867			

June 1, 1906						3" Pipe	
Time	Abs. Pressure	Motor Reading	Wts. of Water	Actual Vel.	Theo. Vel.	Constant	
1.33	8.8	5.2	5.30				
34	do	5.5					
35	do	5.7		50.30	54.70	0.921	
36	do	5.6					
37	do	5.4					
38	do	5.6	7.79				
1.40	8.8	4.5	7.79				
41	do	4.8					
42	do	4.6		46.60	48.75	0.950	
43	do	4.7					
44	do	4.7					
45	do	4.2	10.10				
1.50	8.5	2.9	5.54.5				
51	do	2.7					
52	do	2.7		38.00	38.85	0.948	
53	do	2.8					
54	do	2.8					
55	do	2.7	74.7.5				

[illegible]

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the transparency and accountability of the organization. This section also outlines the various methods used to collect and analyze data, ensuring that the information is reliable and up-to-date.

2. The second part of the document focuses on the implementation of these practices across different departments. It provides a detailed overview of the roles and responsibilities of each team, as well as the specific steps required to ensure compliance with the established protocols. This section also addresses the challenges faced during the implementation process and offers strategies to overcome them.

3. The third part of the document discusses the importance of regular communication and collaboration between all stakeholders. It highlights the need for a clear and consistent flow of information, as well as the importance of providing regular updates on the progress of the project. This section also outlines the various channels used for communication, including meetings, reports, and digital platforms.

4. The fourth part of the document discusses the importance of monitoring and evaluating the performance of the organization. It provides a detailed overview of the various metrics used to measure success, as well as the methods used to collect and analyze this data. This section also addresses the challenges faced during the evaluation process and offers strategies to overcome them.

5. The fifth part of the document discusses the importance of maintaining a high level of security and confidentiality of the organization's data. It provides a detailed overview of the various security measures in place, as well as the methods used to ensure that all data is protected from unauthorized access. This section also addresses the challenges faced during the implementation of these measures and offers strategies to overcome them.

6. The sixth part of the document discusses the importance of maintaining a high level of transparency and accountability of the organization. It provides a detailed overview of the various methods used to ensure that all transactions are properly recorded and reported, as well as the methods used to ensure that the information is reliable and up-to-date. This section also addresses the challenges faced during the implementation of these measures and offers strategies to overcome them.

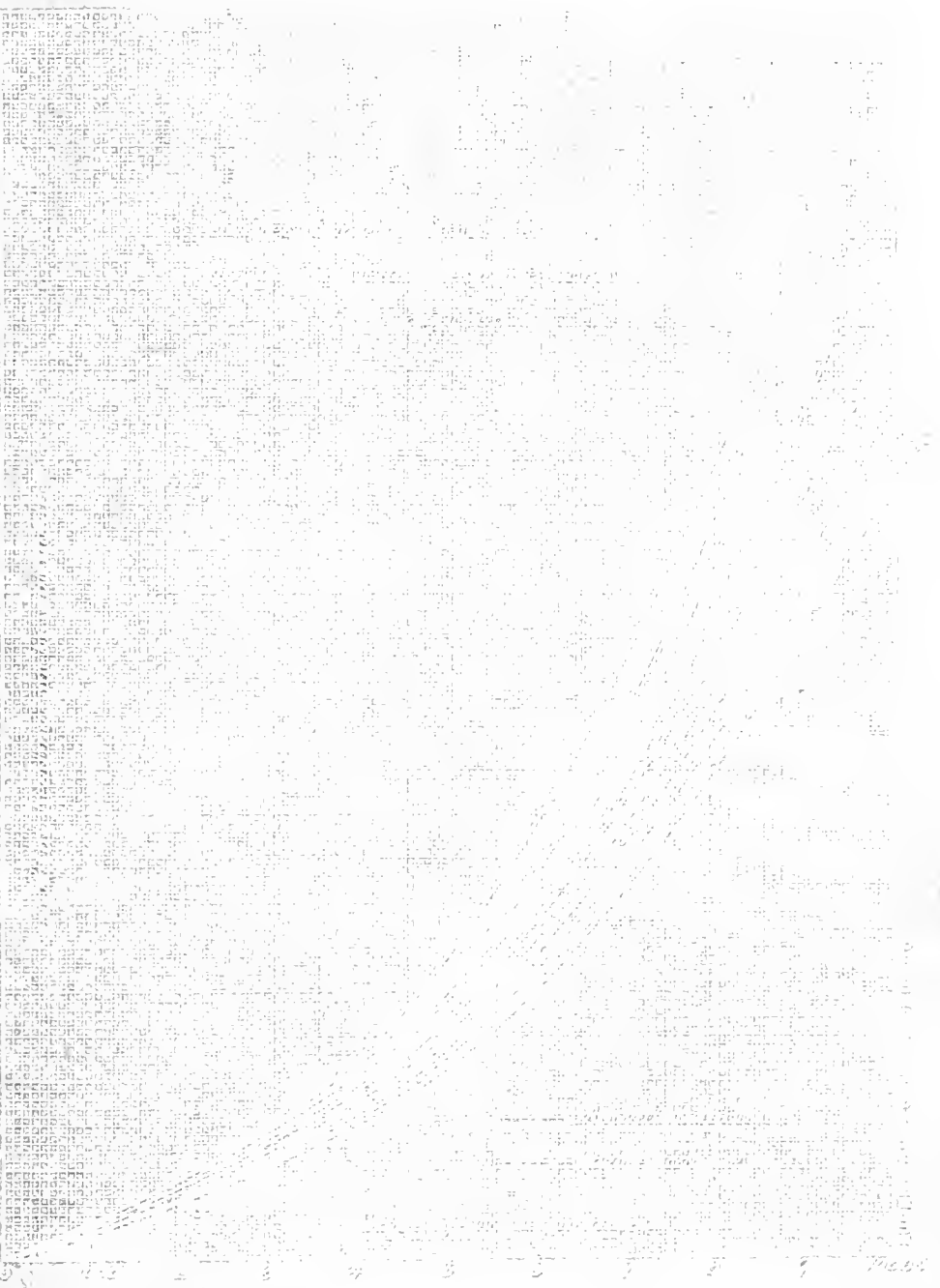
7. The seventh part of the document discusses the importance of maintaining a high level of compliance with all applicable laws and regulations. It provides a detailed overview of the various measures in place to ensure that the organization is always up-to-date with the latest legal requirements. This section also addresses the challenges faced during the implementation of these measures and offers strategies to overcome them.

8. The eighth part of the document discusses the importance of maintaining a high level of customer satisfaction. It provides a detailed overview of the various methods used to ensure that all customers are treated fairly and that their needs are met. This section also addresses the challenges faced during the implementation of these measures and offers strategies to overcome them.

9. The ninth part of the document discusses the importance of maintaining a high level of employee satisfaction. It provides a detailed overview of the various methods used to ensure that all employees are treated fairly and that their needs are met. This section also addresses the challenges faced during the implementation of these measures and offers strategies to overcome them.

10. The tenth part of the document discusses the importance of maintaining a high level of financial stability. It provides a detailed overview of the various methods used to ensure that the organization is always up-to-date with the latest financial requirements. This section also addresses the challenges faced during the implementation of these measures and offers strategies to overcome them.

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